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HOW CHOLERA CAN BE STAMPED OUT.

BY ERNEST HART, EDITOR OF THE "BRITISH MEDICAL JOURNAL," AND CHAIRMAN OF THE NATIONAL HEALTH SOCIETY OF ENGLAND.

WHEN cholera first spread westward from its home in India, across Asia and Europe, its characteristics were so unusual that it was attributed to "telluric," "meteoric," "atmospheric," and such like mysterious influences ; indeed, at the present day there are still many, I regret to know, who attach undue weight to such views. For my own part, I think it is high time that these old notions were put aside, and that the spread of cholera should be looked at practically, in the light of the accumulated evidence afforded by all the great epidemics of the past. That accumulated, and unhappily still accumulating. evidence clearly shows that cholera is a filth disease of specific character, carried by dirty people to dirty places, and there spread by the use of dirty water. With pure water, pure air, pure soil, and pure habits, cholera need not be feared by any nation or by any individual.

To Snow belongs the great honor of being the first to recognize water as a medium of disseminating cholera. His deductions to this effect, from his observations of cholera in England between 1849 and 1854, were confirmed by the elaborate investigations of Farr and Simon. In 1866, following in the same footsteps, I was instrumental in tracing the disastrous cholera epidemic of that year in East London to the distribution of polluted and partially filtered water from the River Lea by the East London Water Company. Since that startling experience I have been convinced that specifically polluted water is not merely an occasion or adjuvant cause, but the *causa causans* of almost every great epidemic of Asiatic cholera, and I have observed that when the use of the infected water has been abandoned or cut off the epidemic has ceased. These views have been fully borne out by a close observation of each successive cholera outbreak within the last thirty years.

ENGLISH EXPERIENCES.

Epidemic of 1831-3.—In England, cholera first appeared in October, 1831, and until the summer of 1833 ravaged various parts of the kingdom. Its extension was so sudden and mysterious that it was popularly looked upon as a visitation of Providence beyond human control. The new disease was carefully studied, and its affinity for the poor, ill-fed, unhealthy parts of the population, and for the unclean, ill-ventilated and crowded districts was fully recognized, but its relation to the water supplies seems to have received little thought. Yet, the general circumstances of the water supplies of England at that time were deplorably bad, and Dr. Snow a few years later collected information which led to the presumption that, as in subsequent epidemics, contaminated water in 1832 played an important part.

Epidemic of 1848–9.—In 1848 occurred the next great visitation of England by cholera. The disease rapidly overran the whole country, and before it had disappeared in epidemic form, towards the close of 1849, 53,293 of the English people had died from it, and 18,887 had died from "diarrhœa," out of a population of some 17,564,656 living in a great variety of circumstances. It was in August, 1849, whilst this epidemic was running its course, that Snow propounded his theory that a most important way in which the disease may be widely disseminated is "by the emptying of sewers into the drinking water of the community." He had found that in most towns in which the malady had prevailed to an unusual extent this means of communication had existed, and he has recorded numerous instances in support of his opinion. He held that the cholera of 1848 was brought to London from Hamburg, that it was increased by infected persons, that the infected sewage matter found its way partly through soil into the wells, and partly through sewers into the Thames and Lea from which a portion of the water supply of London was derived. This theory was adversely criticised at the time, in a report by Drs. Baly and Gull to the London College of Physicians, and, as Mr. N. C. Macnamara has well remarked, these physicians well-nigh nipped this doctrine in the bud, and thus did much to retard the progress of our knowledge of the etiology of cholera.

Epidemic of 1853–4.—Early in the summer of 1854 cholera had obtained a foothold in London, and the outbreak which occurred in St. James's, Westminster, in the neighborhood of the public pump in Broad Street, is of historic interest, as it is the earliest important instance in which the agency of water as a disseminator of cholera was clearly demonstrated. The first death in the parish was recorded early in August, 1854, and throughout that month a few deaths occurred each week, but during the week ending September 2, 78 deaths were registered; in the next week there were 287 deaths; in the following week there were 67, and then the mortality as quickly subsided as it had risen. By the beginning of November there had been some 700 fatal attacks in this single parish; that is to say, 22 out of every 1,000 persons living in the parish had died of the disease within three months. No satisfactory solution of this mysterious outbreak presenting itself Dr. Snow was called in to examine the water supplies. His published report shows the clearly-marked incidence of the disease on those who drank the water of the parish pump. It shows how the workers in one particular factory, where the water was always used, suffered severely from cholera, whilst those in an adjoining brewery, where the water was never used, escaped, and numerous instances of fatal attacks of cholera following the use of the treacherously sparkling water from this pump are detailed. On the drains of the house adjoining the well being opened it was found that there was a cesspool under a common privy, within three feet of the well, and at a higher level than that of the water in the well; that, the walls of the cesspool being rotten, the contents leaked into the surrounding soil; that the walls of the well were also rotten; and that there was distinct evidence of the cesspool contents having for a long time leaked into the well. In the house itself a child aged five months had died on September the 2d of so-called "diarrhœa," but with distinctly choleraic symptoms.

In this case it was a well that was at fault; but in 1848 and 1853, as Mr. (now Sir John) Simon clearly showed in his reports to the General Board of Health, Londoners were also the subjects of gigantic experiments at the hands of some of the water companies, who drew their supplies from the Thames and Lea at points where those rivers were grossly polluted with the sewage and out-scourings of the rapidly-growing metropolis. Carefully gathered statistics show that the people who drank dirty river water suffered from cholera greatly in excess of those whose water supply was from less polluted parts of the rivers.

Epidemic of 1866.—The next choleraic invasion of England was in 1866, and is memorable for the terrible experiment which was unconsciously carried out by another of the London water companies, at the expense of some 4,000 lives in East London. Early in the outbreak I was struck by its incidence on the area supplied with water by the East London Water Company, and I felt confident that it could only be due to a sudden specific pollution of the water supply. Acting on behalf of a great medical journal, I dispatched the late Mr. J. Netten Radcliffe to investigate the matter. After much trouble the result showed that, owing to changes having been made in their filtering apparatus, the company had sent out for a few days unfiltered water, or water in a very partially filtered state, direct from the River Lea, which had just at that moment become infected with choleraic discharges from a cottage of which the sewers were connected with the river, and in which a family infected with cholera had come to reside.

During this epidemic many other parts of England besides London furnished evidence of the relation of water supplies to the spread of cholera.

Since 1866 sanitary improvement throughout England has grown apace, and concurrently Asiatic cholera has not been able to extend or even to establish itself in the country, though cases have reached her shores on numerous occasions. The London water supply is better filtered and of better quality to-day than formerly, but it is still open to criticism in so far as it is derived from the Thames and the Lea at points below where those rivers still receive sewage. The immunity of water companies in distributing poisoned water is a curious and serious anomaly.

EGYPTIAN EXPERIENCES.

Since 1831 Egypt has been severely scourged by cholera at short intervals, but reliable data are not available earlier than the visitation of 1883, when cholera, appearing at Damietta in June, gradually invaded various towns of the Nile Delta, and reached Ghizeh and Cairo by July 16. According to Dr. Sandwith 58,511 deaths from cholera occurred throughout Egypt in 1883 amongst a population of 6,765,000. The definite origin of the epidemic has been much disputed, though there seems to have been ample opportunity for the introduction of the specific infection into Damietta. Once started, however, the condition of Egypt, especially as regards water supply, was, I can say from personal observation, exactly such as would favor the extension of the disease. The Nile is the main source of water supply to the country, and Dr. Sandwith, Sir W. Guyer Hunter, and others, have fully shown the fearful extent to which that river has been and is habitually polluted with human and other filth. Great improvement in the condition of Egypt has taken place during the last ten years, but the question of providing Cairo with proper drainage is still in abeyance, and the water supply of the country is also still far from being satisfactory.

FRENCH EXPERIENCES.

Marseilles has earned an unenviable notoriety as regards cholera in recent years. In 1883 there were some concealed cases; in 1884, 1,777 deaths were recorded; in 1885 there were 1,039 cholera deaths; in 1892 there were some 90 deaths, and in February, 1893, nearly 100 deaths. The insanitary state of the town is notorious, and there is much evidence, which limitations of space prevent me here from referring to in detail, that its public water supply, especially where derived from the sewage-polluted river Huveaune, has been responsible for the epidemics referred to.

Toulon also has suffered severely from cholera at various times, and both its sanitary state and its water supply have been by no means satisfactory.

In 1884 the disease spread from Marseilles throughout the southern and southwestern departments of France, and, as the result of local investigations, Doctor Proust reported that water played an important part in its transmission.

A very detailed account of the cholera epidemic of 1884 in France has been written by Dr. L. H. Thoinot, of Paris, and a concise abstract of it is to be found in Doctor Shakespeare's report on cholera in Europe and India. It shows that the disease spread from place to place by means of soiled personal effects, by small water-courses which had become contaminated with choleraic discharges, or the washing therein of soiled linen, and by the movements of persons experiencing an active or latent attack of cholera.

The Department of Finistère, in the northwest corner of France, furnishes a very vivid object-lesson in the spread of cholera by dirt, sewage-polluted well-waters, and specifically contaminated public fountains, as is shown in the recent very able and interesting report on the subject by Monsieur Henri Monod, who was formerly Prefect of Finistère, and also in the reports made by Doctor Proust after local investigations on behalf of the Comité Consultatif d'Hygiène Publique de France.

In November, 1884, there was a sharp outbreak of cholera in the western suburbs of Paris, the mortality rising rapidly day by day from 1 on November 3 to 96 on November 10, and then as rapidly declining, in the manner characteristic of water-borne epidemics, and I had excellent reasons for believing that the epidemic was due to the temporary distribution of a highly-polluted water to particular districts of the city. Again, in 1892, Paris, more especially its western and northwestern suburbs, was once more somewhat severely visited by cholera. Breaking out in Paris in a crowded prison at Nantarre, on the west of Paris, the disease soon spread through the neighboring districts, and before the end of the year 977 deaths had been chronicled.

There is a very general consensus of opinion that the consumption of the Seine water was at the root of this serious outbreak, as it has been at the root of previous epidemics. The suburban districts in the north and northwest—those districts, in fact, where cholera raged in 1892, and where it began in 1884—draw their water from the Seine after it has passed through Paris and been fouled by steamer traffic, by the filth from the cholera and linen washed in its floating wash-houses, by innumerable private sewers and by the contents of the main sewers of Paris at Asinieres and St. Denis. Happily, works have been undertaken to improve the Parisian water supply.

ITALIAN EXPERIENCES.

It is to Marseilles and Toulon that Italy is indebted for the severe epidemic of cholera which swept over the country in the autumn of 1884. Breaking through the quarantines on the Italian frontier, the disease was carried by fugitive workmen throughout the country, and before the end of the year some 27,000 attacks of cholera and upwards of 14,000 deaths had occurred, at least 44 out of the 66 Italian provinces having been visited.

The severest outbreak occurred in Naples. Introduced there in August, 1884, from Marseilles, the attacks and mortality rose by rapid daily strides, until September 11, and then as rapidly fell. Between August 23 and November 9, some 12,345 cases and 7,086 deaths occurred amongst a population of 492,908. At that period the water supply of Naples was mainly derived from trenches running from house to house underground, and was exposed to direct contamination, not only by soakage of filth, but by the reckless practice of washing in the trenches linen soiled with choleraic discharges. In the following year Naples was supplied with pure water from a distant mountain stream (the Serino), and there followed a marked immunity of the city from cholera, notwithstanding the presence of the disease in the neighborhood. In 1888, however, an injury to the Serino water conduit led to a temporary return to the old system, and two sharp epidemics of cholera at once ensued, but ceased upon the resumption of the purer supply.

In September, 1884, the disease reached Genoa. After a few sporadic cases, a sudden and widespread explosion occurred between the 21st and 24th of September, the rich and poor being indiscriminately attacked. Genoa has a fine supply of naturally good water, brought from a distance by three aqueducts. On close investigation it was observed that of the first 300 cases of cholera, 93 per cent. were in houses supplied by one of those aqueducts (the Nicolay), and on following that aqueduct to its commencement, near the village of Busalla, 13 miles distant, a colony of workmen was found encamped. Cholera had broken out in Busalla on September 14, and inquiry disclosed the fact that the clothing of the workmen, both of the sick and of the healthy, was washed in the river Scrivia, which feeds the Nicolay Aqueduct. The supply of this water to Genoa was promptly stopped on September 28, and the epidemic at once rapidly declined.

In 1885 the most severe epidemic occurred in Palermo, in

Sicily. Into this somewhat unsavory town the disease was brought by sea, notwithstanding a stringent quarantine, and between the middle of September and the middle of November 5,535 cases, of which 2,959 were fatal, occurred, among a population of about 275,000. In Palermo the water is obtained partly from open trenches passing beneath the houses, as at Naples; partly from public fountains, and partly from wells which are exposed to the most filthy contamination. Apart from other pollutions, the water trenches are fouled through the very common custom of washing clothes in them. Doctor Albonesi was, at the time, director of the local sanitary council, and to his enlightened and vigorous administration, and prompt dealing with the dangerous water sources, is due the early termination of the epidemic.

SPANISH EXPERIENCES.

In 1885 Spain was the scene of a cholera outbreak of exceptional ferocity. Introduced into Alicante, on the southeast coast, in spite of quarantine, in August, 1884, the disease slumbered through the following winter, and in April, 1885, burst into an epidemic at Jativa and Alcira, when, evading sanitary cordons, it was soon carried far and wide by the dispersing laborers. Between February 5 and December 31, 1885, 2,247 local governments, having an aggregate population of 6,575,641, had been invaded, and 338,685 cases and 119,624 deaths had occurred.

Sanitation and domestic hygiene are of a very primitive description in Spain. Filth is allowed to accumulate, there is rarely any drainage properly so called, and the water supply is for the most part derived from the open and unprotected rivers and streams. In a work published in 1886, Mr. George Higgin has, by comparative pictures of the facts respecting a number of typical towns, very clearly shown that the Spanish epidemic of 1885 was *par excellence* water-borne. He shows that the disease never became truly epidemic or dangerous in any Spanish city in which there was a pure supply of water, and where proper means were taken to guard against the sources being polluted from any specific choleraic poison. He shows how, in this way, the cities of Toledo, Seville, Malaga and Madrid escaped comparatively lightly, whilst such places as Aranjuez, Saragossa, Granada and Valencia suffered very lightly.

RUSSIAN EXPERIENCES IN 1892.

The complete history of the fearful cholera mortality in Russia in 1892 still remains to be written; but what we know of it bears out previous experiences as to the influences of infected water. In a series of papers recently published in the *Lancet*, Dr. Frank Clemow, of St. Petersburg, has collected a large number of facts bearing this out. A particularly instructive case is narrated by the United States Consul at Tashkent, in Turkestan. At Ashabad the cholera had already disappeared early in August, 1892, and the event was celebrated with much rejoicing. The Governor-General gave a dinner, but one-half of the guests died of cholera within twenty-four hours. Further, out of the 13,000 inhabitants of Ashabad, 1,300, or ten per cent., died within forty-eight hours. The cause of this outbreak was traced to a small stream of water which supplied the town, and which, it was found, had been fouled by filth from a small Turcoman village on its banks, where cholera had broken out four days previously.

CHOLERA AT HAMBURG IN 1892.

Cholera was officially announced in Hamburg on August 21, 1892, but it had been found present in the town for some days previously. The influence of the public water supply in disseminating the disease may be seen in the incidence of the disease respectively on Hamburg, Altona and Wandsbeck, the three towns which make up the Greater Hamburg. Wandsbeck, with a population of 20,571, had 64 cases (3.1 per mille), and 43 deaths (2.0 per mille); Altona, with 173,279 inhabitants, had 572 cases (3.9), with 328 deaths (2.3); Hamburg State, with a population of 622,530, had 17,974 cases (28.8), and 7,611 deaths (12.2); or, taking only the infected parts, the town and suburbs of Hamburg, among 579,907 inhabitants there were 17,891 cases (30.8) and 7,582 deaths (13). Wandsbeck, which suffered less than the other two, is supplied with spring water, whereas Altona and Hamburg derive their water from the Elbe. Altona, however, gets its water very far down, at Blankensee, where the river is cleaner than in Hamburg, and passes it through a good gravel filter, unlike Hamburg, which takes its water from the harbor, contaminated with sewage and absolutely unfiltered. Happily, steps have been taken to secure purer water to Hamburg in the future.

INDIAN EXPERIENCES.

India is generally referred to as the "home of cholera," the disease being established endemically throughout a wide area. This, however, is not, as most Indian authorities once believed and many would even now have us believe, due to any mysterious or unpreventable causes, but in virtue of conditions which may all of them be removed, and which in time, I trust, will be removed. In India, as elsewhere, water has been the chief nurse and disseminator of cholera, and I believe that if every town and village in India were provided with pure and properly protected water, the so-called "endemic area" would soon become indefinite. Dr. M. C. Furnell, who has had great experience as Surgeon-General of Madras, is firmly of opinion that the general method of the propagation of cholera in India is by means of specifically polluted water, and he has had no difficulty in finding masses of facts in support of his opinions.

The experiences of Calcutta, as observed by Dr. W. J. Simpson, the Health Officer of that city, go to show that those persons who have an abundant and pure water supply, namely, the Europeans and better class of natives—escape cholera epidemics, except in isolated instances which can generally be accounted for; while the natives, who necessarily depend on tank water, suffer severely when a tank becomes polluted by the excreta of a cholera patient. It must be remembered that the natives bathe and wash their utensils and clothes in the tank because it is the only available place for doing so, and that they use the water of the tank, contaminated as it is, in addition, by soakage and sewage, for cooking and drinking, because it is the only available water supply for domestic purposes. Dr. Simpson raises a very earnest cry against the scarcity of pure water. The first requisite for Howrah and the suburbs of Calcutta is a liberal water supply, whilst Calcutta itself needs an increased supply.

Madras also furnishes instructive experiences. Before the introduction of the Red Hills water supply Madras suffered each year severely from cholera ; but since 1872, when the water supply was first opened, the disease has practically disappeared from the city. The experiences of Pondicherry, Gopaulpore, Nagpur, Salem, Peshawar, and other places, may be quoted as showing a marked immunity from cholera, when pure uninfected water has been in use.

Religious pilgrimages, also, are a fruitful means of spreading cholera in the East, owing to the habit of bathing and drinking the water of the sacred wells and pools. Graphic descriptions of the Mecca pilgrimage of 1866, or of the Ardhodoya Jog held at Calcutta in 1891, and of the Kumb festival at Hurdwar, 1891, are before me and bear out this statement.

Under English rule much has been done in India in the way of sanitary reform, but very much still remains to be done, and I cannot but recognize the very heavy responsibilities which rest on England in regard to this matter. It appears to me that the sanitary administration of India requires to be radically remodelled, and I venture to submit that this could without insuperable difficulties be effected. I would suggest (1), an Imperial Sanitary Department attached to the Government of India ; (2), a Provincial Sanitary Department attached to each of the Provincial Governments, such as Bengal, North West Provinces, Punjab, Madras, Bombay, etc., and (3), a Local Sanitary Department attached to each municipality, district board, etc.

I have been unable within the space here at my disposal to attempt to give more than the merest indication of the mass of evidence which I have accumulated, showing that water is the chief if not—in Europe—the sole agency in the spread of epidemic cholera. With the scourge close at our gates let me urge upon every community and every responsible authority in America to profit by these lessons before it is too late ; to put their houses in order and secure purity of water especially, but also of soil, of air, of habits. This is the best, the only successful, weapon wherewith to protect ourselves against cholera. Quarantine is a sieve rather than a protective armor.

ERNEST HART.